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EXAMINER

ZERVIGON, RUDY

ART UNIT PAPER NUMBER

1763

DATE MAILED: 03/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/123,352

Applicant(s)

LI ET AL.

Examiner

Rudy Zervigon

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED. (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 22-25, 35-37, 41, 42 and 46-60 is/are pending in the application.
- 4a) Of the above claim(s) 54-60 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 22-25, 35-37, 41, 42 and 46-53 is/are rejected.
- 7) ☒ Claim(s) 47 and 48 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

Election/Restriction

2. Newly submitted claims 54-60 are directed to an invention that is independent or distinct from the invention originally claimed for the following reasons:

Inventions of claims 22-25, 35-37, 41, 42, and 45-53 and claims 54-60 are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus as claimed can be used to practice another and materially different process, for example, a chemical vapor deposition (CVD) process without plasma generation/utilization.

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims 54-60 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

invention.

Specification

3. The substitute specification filed July 10, 2003 has been entered.

Claim Objections

4. Applicant is advised that should claim 47 be found allowable, claim 48 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Claim Rejections – 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 22-25, 37, 41, 42, and 46-51 are rejected under 35 U.S.C. 102(b) as being anticipated by Sato et al¹ (JP07-201831). Sato teaches a plasma generation apparatus (abstract; all Figures), comprising:
- i. A vacuum vessel (abstract, Purpose, item 1; All Figures) having a plasma generation region established in an interior thereof (section [0001] of computer translation);
 - ii. A gas inductor (8, Figure 4; [0030]) that inducts discharge gas into the interior of the vacuum vessel
 - iii. An exhaust (7, Figure 4; [0030]) that exhausts an atmosphere in the interior of the vacuum vessel

¹ Computer Translation from

<http://www6.ipdl.jpo.go.jp/Tokujitu/PAJdetail.ipdl?N0000=60&N0120=01&N2001=2&N3001=H07-201831>

- iv. A tube shaped discharge electrode (9, Figure 4; [0045]) fashioned so as to enclose the plasma generation region, and having a tube-shaped wall (surface of item 9) extending in a substantially vertical direction with respect to a substrate stage surface – Sato does not specify how the apparatus is configured to be positioned, either horizontally or vertically, however it is the Examiner's opinion that in any orientation either "horizontal" or "vertical" or any position in between, Sato's invention would function properly. Additionally, when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent (In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977); MPEP 2112.01).
- v. A first high-frequency electric power applicator (19, Figure 4; [0045]) that applies first high-frequency electric power to the discharge electrode;
- vi. A first magnetic force line generating portion (left-most magnet 402, Figure 4; [0051]) positioned near one end portion (left side) of an outer periphery of the discharge electrode (Figure 4);
- vii. A second magnetic force line generating portion (right-most magnet 402, Figure 4; [0051]) positioned near the other end portion (right side) of an outer periphery of the discharge electrode (Figure 4);
- viii. A substrate stage (5, Figure 4) on which the substrate (6, Figure 4) is carried within the plasma generation region, the substrate stage (5, Figure 4) provided at a lower portion (peripherally) of the plasma generation region and having a substrate stage (5/6 Interface) on which the substrate is carried within the plasma generation region, the substrate stage surface extending in a substantially horizontal direction – Sato does not specify how the apparatus is

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configured to be positioned, either horizontally or vertically, however it is the Examiner's opinion that in any orientation either "horizontal" or "vertical" or any position in between, Sato's invention would function properly. Additionally, when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent (In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977); MPEP 2112.01).

- ix. Wherein at least one of the first (left-most magnet 402, Figure 4; [0051]) and second (right-most magnet 402, Figure 4; [0051]) magnetic force line generating portions is overlapped with one end portion (terminating edges Figure 4) of the outer periphery side of the discharge electrode (9, Figure 4; [0045]) including the one end thereof – The machine translation of Sato supports plural permanent magnets with reference to Figure 4 ("3rd Example", [0045]) whose magnetic field confinement is identical to the 1st and 2nd examples ([0026]) and the "magnetic circuit 4 consists of two or more ring-like permanent magnets 401,402 put in order and installed at the suitable interval." ([0028]). Because the specification details adding additional first and second magnets the specification teaches such a plural addition would ultimately conform to and overlap with one end portion (terminating edges Figure 4) of the outer periphery side of the discharge electrode.
- x. Two walls electrodes (each item 5, Figure 4; [0027]) positioned so as to sandwich the plasma generation region between them, in the direction of the center axis of the discharge electrode, for defining the scope of the plasma generation region in the direction of the center axis (Figure 4);

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- xi. The magnetic force line generating portion fashioned so as to generate magnetic force lines having portions roughly parallel to the center axis of the discharge electrode, such that the length of the parallel portions become longer the closer the magnetic force lines are to the center, the magnetic force lines capable of trapping electrons at least in a center of the plasma generation region and being shaped so that they do not intersect the two walls in the center of the plasma generation region – compare magnetic arrangement (42) of Applicant's Figures and Sato's magnetic arrangement (Figure 4). Additionally, when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent (In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977); MPEP 2112.01). Figure 4 of Sato provides a teaching of the strength of the magnets as noted by the flux lines 501-503.
- xii. Portions of the first and second magnetic force line generating portions output and input magnetic force lines into and out of the plasma generating region. Refer to MPEP 2112.01 discussed above.
- xiii. The first magnetic force line generating portion (unit) comprises a magnet (N magnet of 401), and is fashioned so that a N (north) pole of the first magnet faces the plasma generation region and an extended line (axis of symmetry of the magnet) of a straight line (axis of symmetry of the magnet) connecting a N pole and a S pole of the magnet intersects a center axis of the discharge electrode *substantially perpendicular to a peripheral direction (axial symmetric direction) of the discharge electrode* about at a right angle – The "straight line" connecting a N pole and a S pole of the magnet is the geometric line (not shown) where

magnetic field lines meet by divergence or convergence (cusp) and thus intersects the center axis of the discharge electrode at a right angle.

- xiv. The second magnetic force line generating portion (unit) comprises a second magnet (S magnet of 401), and is fashioned so that a S (south) pole of the magnet faces the plasma generation region and an extended line (axis of symmetry of the magnet) of a straight line (axis of symmetry of the magnet) connecting a N pole and a S pole of the magnet intersects the center axis of the discharge electrode about at a right angle
- xv. A magnetic pole (any one of the North or South) of the first magnetic force line generating portion (left-most magnet 402, Figure 4; [0051]) on the plasma generation region side (9/Magnet interface; Figure 4) is opposite to a magnetic pole (any one of the North or South) of the second magnetic force line generating portion (right-most magnet 402, Figure 4; [0051]) on the plasma generation region side (9/Magnet interface; Figure 4), as claimed by claim 47 and 48
- xvi. An upper wall (1, Figure 4), coupled to a reference potential (Figure 4, See grounding connection), provided at an upper portion of the plasma generation region so as to oppose the substrate stage (opposite 5, Figure 4), as claimed by claim 50 – As above, Sato does not specify how the apparatus is configured to be positioned, either horizontally or vertically, however it is the Examiner's opinion that in any orientation either "horizontal" or "vertical" or any position in between, Sato's invention would function properly. Additionally, when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent (In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977); MPEP 2112.01)

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- xvii. A second high-frequency electric power applicator (not shown) that applies second high-frequency electric power to the substrate stage, as claimed by claim 51 – “When giving the bias of a direct current or an alternating current to the substrate maintenance mechanism 5 and processing the front face of the processed substrate 6 especially...” see section [0044] of Sato.

Claim Rejections – 35 USC § 103

7. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

8. Claim 53 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (JP07-201831). Sato is discussed above. Sato further teaches that his gas inductor (8, Figure 4; [0030]) inducts discharge gas into the interior of the vacuum vessel through a side wall. Sato further teaches that Sato's exhaust (7, Figure 4) exhausts the atmosphere in the interior of the vacuum vessel from the level side of the substrate stage (5, Figure 4). As a result, Sato does not teach that his gas inductor (8, Figure 4; [0030]) inducts discharge gas into the interior of the vacuum vessel through an “upper wall”.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to induct the process gas into the interior of the vacuum vessel through an upper wall of Sato's vacuum vessel.

Motivation to induct the process gas into the interior of the vacuum vessel through an upper wall of Sato's vacuum vessel is to provide an alternate and equivalent means for locating the gas inductor.

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9. Claims 36 and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (JP07-201831) and Shamouilian et al (USPat. 6,095,084), in view of Koshimizu (USPat. 5,997,687). Sato and Shamouilian are discussed above. Sato and Shamouilian do not teach a high-frequency resonant circuit that provides a resonant frequency between the first and the second high-frequency electric power supply. Additionally, Sato and Shamouilian do not teach a controller that controls the magnitude of the first and second high-frequency electric power with a predetermined power ratio between the first and second high-frequency electric power supplies. Koshimizu teaches a similar diode plasma reactor (Figure 4) comprising a high-frequency resonant circuit (125, 132; column 5, lines 52-59; column 6, lines 5-13) that provides a resonant frequency ("resonance conditions") between a first (128) and a second (136) high-frequency electric power supply applied to two walls (112, 104) of which one (112) is a gas diffusion plate. Koshimizu further teaches a controller (129; Figure 4) that controls the magnitude of the first and second high-frequency electric power (column 5, lines 60-65).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Koshimizu's high-frequency resonant circuit and controller between the two high-frequency sources of Sato and Shamouilian apparatus to control and set a predetermined power ratio between the first and second high-frequency electric power supplies.

Motivation to use Koshimizu's high-frequency resonant circuit between the two high-frequency sources of the Sato and Shamouilian apparatus is to control the plasma to ensure uniform processing and to protect the processed wafer from damage (column 6, lines 23-26). Motivation for providing a constant power ratio between the high-frequency power sources is drawn to the optimization of the operation of the apparatus. Inclusive, it would be obvious to those of ordinary

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skill in the art to optimize the operation of the claimed invention (In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980); In re Hoeschele, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969); Merck & Co. Inc. v. Biocraft Laboratories Inc., 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. Denied, 493 U.S. 975 (1989); In re Kulling, 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990), MPEP 2144.05).

10. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (JP07-201831) in view of Koshimizu (USPat. 5,980,687). Sato was discussed above. Sato does not teach a position adjuster that adjusts positions of the two walls in the center axis of the discharge electrode. Koshimizu (USPat. 5,980,687) teaches a similar diode plasma reactor (Figure 4) including a position adjuster ("driving mechanism" column 3, lines 49-61; column 4, lines 15-22) that adjusts positions of the two walls (116, 110).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Koshimizu's position adjuster to adjust the position of Sato's two walls.

Motivation to use Koshimizu's position adjuster that adjusts positions of Sato's two walls is to improve uniformity of the generated plasma as taught by Koshimizu.

Response to Arguments

11. Applicant's arguments filed July 7, 2003 have been fully considered but they are not persuasive.

12. Applicant states that his invention would outperform the operation of Sato's invention because Applicant's invention provides a "wall of the tube-shaped discharge electrode is disposed to extend in the vertical direction", whereas Sato's invention is shown to extend, on the page, in a horizontal direction. As stated above, Sato does not specify how the apparatus is

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configured to be positioned, either horizontally or vertically, however it is the Examiner's opinion that in any orientation either "horizontal" or "vertical" or any position in between, Sato's invention would function properly. Additionally, when the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent (In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433 (CCPA 1977); MPEP 2112.01).

13. Applicant's arguments directed to newly submitted claim 51 is addressed in the body of the claim rejections above.

14. Applicant states that "in the present invention, since the upper electrode is directly earthed (grounded), the voltage difference between the discharge electrode applied with the high-frequency electric power becomes large as compared...", however, Applicant does not claim an "upper electrode". As a result, Applicant is arguing limitations which are not claimed. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., "upper electrode") are not recited in the rejected claims. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See In re Van Geuns, 988 F.2d 1181, 26 USPQ2d

15. Applicant states that Sato's substrate processing arrangement (Figure 4) where "the gas is introduced from the gas introduction tube 8 of the side wall and supplied to the two substrates 6" does not provide uniform processing of the two substrates. The Examiner recognizes that Sato's number of processing substrates, either one or two, is an argument based on the intended use of Sato's apparatus. It is well established that apparatus claims must be structurally distinguished from the prior art (In re Danley, 120 USPQ 528, 531 (CCPA 1959). "Apparatus claims cover

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what a device is, not what a device does ."(emphasis in original) Hewlett - Packard Co . v. Bausch & Lomb Inc ., 15 USPQ2d 1525, 1528 (Fed. Cir. 1990), MPEP – 2114). Further, a claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Exparte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

16. Applicant's argument that Sato's does not teach providing magnetic force line generating portions is provided "so as to overlap with the one end portion of the outer periphery side of the discharge electrode" is not convincing. As stated above, Sato allows for greater than two magnetic force line generating portions which would ultimately and necessarily "overlap with the one end portion of the outer periphery side of the discharge electrode" as taught by Sato ([0028]):

The machine translation of Sato supports plural permanent magnets with reference to Figure 4 ("3rd Example", [0045]) whose magnetic field confinement is identical to the 1st and 2nd examples ([0026]) and the "magnetic circuit 4 consists of two or more ring-like permanent magnets 401,402 put in order and installed at the suitable interval." ([0028]). Because the specification details adding additional first and second magnets the specification teaches such a plural addition would ultimately conform to and overlap with one end portion (terminating edges Figure 4) of the outer periphery side of the discharge electrode.

Conclusion

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (703) 305-1351. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official after final fax phone number for the 1763 art unit is (703) 872-9311. The official before final fax phone number for the 1763 art unit is (703) 872-9310. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (703) 308-0661. If the examiner can not be reached please contact the examiner's supervisor, Gregory L. Mills, at (703) 308-1633.

Rudy Zervigon
2-24-4
13:30